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CONTENTS:

Regression of × Quercus Deamii toward Quercus macrocarpa and Quercus Muhlenbergii. *H. H. Bartlett* 249

Species Newly or Rarely Reported from Nova Scotia and Cape Breton Island. *D. S. Erskine* 264

New Zealand Botanists. *Joseph Ewan* 271

Wolffia columbiana in Methuen, Massachusetts. *Stuart K. Harris and Ralph C. Bean* 272

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THE NEW ENGLAND BOTANICAL CLUB

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REGRESSION OF × QUERCUS DEAMII TOWARD QUERCUS MACROCARPA AND QUERCUS MUHLENBERGII[1]

H. H. Bartlett

From a genetical standpoint there is of course no reason why oak hybrids should not give true-breeding intermediates, either by segregation, which would require much time, or by doubling of the chromosome number. Before general botanists became genetically conscious there was a tradition, based upon more or less casual observations of nurserymen and others, that oak hybrids came true from seed. This was believed to be true for Bartram's oak, *Quercus heterophylla* Michx. f., from the time of Engelmann (6) until MacDougall (10) showed regression toward the parents in progenies of young seedlings. In *Quercus Rudkini* Britton, another supposed black-oak hybrid, on the contrary, he was unable to demonstrate regression to his satisfaction, although the evidence might have indicated regression toward one of the supposed parents, even if not toward the other.

The usual experience of botanists has been that hybrids are less common in Leucobalanus (the white oaks) than in Melanobalanus (the black oaks). However that may be, gradually increasing numbers of white-oak hybrids have been reported, so that many of the possible combinations are fairly well known or at least suspected to exist. The reports, by Britton and Shafer (1), Bush (2), Hampton (7), Hitchcock (8), Sargent (12; 13), Sudworth (14) and Trelease (15; 16), have not always been supported by satisfactory evidence, even though intrinsically

[1] Papers from the Department of Botany and the Botanical Gardens of the University of Michigan, no. *946*.

credible. It is the purpose of this article to show that one particular white-oak hybrid, × *Quercus Deamii*, is probably *Quercus macrocarpa* × *Q. Muhlenbergii* rather than *Q. alba* × *Q. Muhlenbergii*, as it has been reported to be, and that it shows definite regression toward the supposed parents, but whether by segregation following inbreeding or by out-crossing, or by both processes, there is no evidence.

The subject is one which has been developed by such disconnected reports over so long a time that a writer is tempted either to disregard the background entirely or to swamp a small amount of new information with a disproportionate amount of historical gleanings. Believing that the reader will find the gleanings distinctly useful, they are given as annotations of those cited publications that provide the background for what little knowledge has grown up about hybrids of our East-American oaks in general and our white oaks in particular. Observations have been quoted which have any bearing on the heredity of the peculiar long-appendaged cup scales which make up the distinctive "fringe" of *Quercus macrocarpa*, since the lack of this cup-fringe would seem to be one of the most useful criteria to look for in the search for new examples of bur-oak hybrids. The cup fringe appears to be completely or nearly recessive. Evidence will be found in publications of Bush (2), Hitchcock (8), James (9), Rehder (11), and Sargent (12). Trees with leaves resembling those of *Q. macrocarpa* (if outside the range of *Q. stellata*) but either lacking the fringe or showing it only slightly developed, should be suspected of some degree of hybridity. If possible, acorns or young seedlings should be planted in definitely recorded positions (preferably assured by gift of acorns to some Botanical Garden or Arboretum) where the trees can come to maturity without being again transplanted. The wood of *Q. macrocarpa* is as valuable as that of *Q. alba* (some consider it better) and is frequently confused with it commercially, so every hybrid progeny grown might become a contribution to the timber-tree breeding program of the future.

In 1904 the late Mr. Lent A. Williamson, of Bluffton, Indiana, and his son, Mr. E. B. Williamson, discovered a hybrid oak to which Mr. C. C. Deam subsequently devoted much study. Fertile specimens were collected by E. B. Williamson on October

9, 1904. He was even then primarily a specialist in dragon-flies, and was eventually to become a professional entomologist. The two Bluffton naturalists, Deam and E. B. Williamson, were zealous companions in field work, and since the former was the botanist, it was quite in order that the oak should have been eventually named in honor of Mr. Deam, for it was he who studied and distributed specimens and propagating material of the hybrid and requested opinions of its parentage from a number of his botanical correspondents.

George B. Sudworth, Dendrologist of the U. S. Forest Service, expressed the opinion that the hybrid was *Q. acuminata* × *alba* and the specimens were so labelled. (The name *Q. Muhlenbergii* Englem. is now accepted for *Q. acuminata* (Michx.) Sarg.) Deam (3) described the hybrid in 1911. Subsequently it was named × *Quercus Deamii* by Trelease (15; 16).

After supposedly having been cut, the original tree was rediscovered some years later. In order to secure its preservation in 1915, when it was again about to be cut, Mr. and Mrs. Deam bought the plot of land on which it stands and deeded it to the State of Indiana, which has officially designated specimen and site as the "Deam Oak Monument." The tree which is supposed to be and undoubtedly is the actual type is located about three miles northwest of Bluffton, Indiana, on State Highway 116, and in March, 1939, had a circumference of 90 inches at breast height. Since there may seem to be a possibility of doubt, in view of Deam's statement of 1911 that "an effort was made to save the tree but it was cut a few years afterward," the actual type material may be considered to be the specimens collected by Mr. E. B. Williamson Oct. 9, 1904, which were sent by Deam to the National Herbarium, the writer, and others.

A photograph of the Deam oak was used for the frontispiece of the Flora of Indiana (5). Deam commented that in 1904–5 he had made a collecting trip to Guatemala and at the request of William Trelease of the Missouri Botanical Garden collected Agave and Fourcraea for him. In recognition of this favor and without Mr. Deam's knowledge, Trelease named this tree × *Quercus Deamii,* although Mr. Deam felt that it should have been named for the Williamsons.

The tree has had three of its own nursery-grown seedlings planted about it, and there will undoubtedly be spontaneous seedlings, insuring that the living memorial to Mr. Deam will still remain after the original tree is gone. This pleasant circumstance will inform many a passer-by of Mr. Deam's life-time service to the State and to botanical science, definitively recorded in one of the best state or regional floras hitherto produced in America.

That resolving the problem of parentage of this oak was uppermost in Mr. Deam's mind at the time of its discovery is indicated by correspondence and herbarium specimens showing that he was collecting and studying one of the putative parents, the locally scarce *Q. Muhlenbergii*, at Bluffton, during the same week when Mr. Williamson collected the type material of the hybrid. No seedlings were then obtained from acorns of the latter, for Mr. Deam states in the "Flora" that the hybrid yielded *viable* acorns in 1918, 1927, and 1930. He sent one of the early seedlings (presumably from the crop of 1918) to the Botanical Gardens of the University of Michigan in April, 1926 (accession no. 9385). Later he sent acorns of the 1927 crop (accession no. 12029) from which seven seedlings were obtained, which still survive, although one is a runt which loses its few upper leaves before Fall, finishing the growing season with sprout leaves only. It has undoubtedly suffered from the competition of the three more vigorus seedlings that were planted in the same group with it. At the time of being transplanted from pots to the open garden, the seedlings did not appear any too vigorous, and, in anticipation that not all would live, they were planted in two compact groups, of four and three, respectively. Now, having reached the age of a quarter century, all but the one exceptional weakling have done well, but must now be separated to insure proper development. Inevitably they will suffer a set-back from transplanting and notes are therefore presented herewith on the older seedling and the six of the later planting which have developed normally and have foliage of adult type. These exhibit clear evidence of hybrid segregation toward one of the species which were supposed by Sudworth to be the parents, namely *Quercus Muhlenbergii*. There is no convincing evidence for *Quercus alba* having been the other parent, but, instead, *Q.*

macrocarpa Michx. is indicated. Sudworth seems to have made no reference to his opinion in print, at least not before 1917 (14).

The seedlings (aside from the weakling with only abnormal sprout foliage) fall into three groups, as will be seen by inspection of Table I. Two closely resemble Indiana material of *Q. Muhlenbergii*, but the leaves are in general too acute at the base. Otherwise they would undoubtedly, if found wild, go with that species. They differ in leaf width, and have done so consistently, growing together and nearly enough equally developed so that competition has not adversely affected either. Where the branches intermingle the leaf difference is obvious, but in a natural woodland it would probably be considered an environmental effect. Two are fairly close to the original herbarium material from the type tree of × *Q. Deamii*. Three approach *Q. macrocarpa* but do not reach the most extreme development of leaf constriction between a terminal flabelliform segment and a lobate basal segment that is shown by that species. In pure *Q. macrocarpa* the constriction, on one side at least, may reach to the midrib.

Both in the hybrids and in *Q. macrocarpa* the leaf is likely to be markedly asymmetrical, one side having a lateral lobe between the constriction and the big flabelliform end-segment. This extra lobe receives two veins, or, if only one, the latter has a strong downwardly directed branch. The flabelliform end segment of *Q. macrocarpa* may have lobes of the same sort, which are also similar to the lobes of *Q. alba*. The chestnut oaks have simple, evenly spaced teeth, sinuations, or lobes, which correspond to single, non-forked veins.

The acorns might be expected to provide striking evidence of *Q. macrocarpa* being an ancestor of × *Q. Deamii*, instead of (or in addition to) *Q. alba*. These are only beginning to be borne by the seedlings. One resembling *Q. Muhlenbergii* has non-fimbriate acorn cups, like that species. One resembling *Q. macrocarpa* is non-fimbriate, but another shows an intermediate condition, with some few of the marginal scales forming setiform appendages and others not. The fimbriate acorn-cup is characteristic of *Q. macrocarpa*, not of *Q. alba*.

Finally, it will be noted from Table I that none of the hybrids resembles *Q. alba* in having the lower surface of the leaf glabrous.

One (no. 12029–6) on the contrary, has had to be set aside from the others because of having some of the terminal leaves of the season's growth thinly pubescent above, although showing mature characteristics otherwise. Not too much importance can be given to this feature until the tree is separated from two that have greatly outgrown it, by which it is completely shaded. It appears to be genetically of very slow growth, possibly a half-dwarf. The greater persistence of pubescence on the upper leaf surface may, of course, have a genetical basis.

All of the seedlings have grown rather slowly, but the stronger ones have kept up with two seedlings of the tree, exceedingly rare in Wells County, Indiana, which Deam reported in the Flora of Indiana as *Q. macrocarpa* var. *olivaeformis* (Michx. f.) Gray. The circumferences of the seedlings both breast-high and just above the basal swelling are as follows, at the age of 25 years:

No. 12029–1: 53 cm.; 76 cm.
No. 12029–2: 29 cm.; 40.5 cm.
No. 12029–3: 26 cm.; 35.5 cm.
No. 12029–4: 45.5 cm.; 61.5 cm.
No. 12029–5: 36 cm.; 48 cm.
No. 12029–6: 23 cm.; 30 cm.

The leaf form of type material of × *Quercus Deamii* (in herb. Univ. Mich. *ex* herb. Bartlett) indicates clearly that one of the chestnut oaks was a parent (or ancestor) and this parent would reasonably seem to be *Quercus Muhlenbergii* (= *Q. acuminata*). The latter, known as sweet oak in northern Indiana, is the only chestnut oak found in Wells County. The basket oak, *Quercus Michauxii* (unfortunately, with possibility of vast confusion, it may be necessary to accept the long misapplied name *Q. Prinus* for this, as Fernald does in the current edition of Gray's Manual) is found only in the southern counties. *Quercus montana* does not extend northward even to the center of the state, and *Quercus prinoides* has been found only in one county of the northern tier. So if × *Q. Deamii* is a primary or even recent hybrid, the evidence from geographic distribution points inevitably to *Q. Muhlenbergii* as the chestnut-oak parent. This would account for the acute or subacute dentition, and likewise the narrow leaves of the most extreme segregate toward *Q. Muhlenbergii*, which is, in fact, an almost perfect match. This and at least one other seedling deviating toward *Q. Muhlenbergii*

TABLE I. Characteristics of × *Quercus Deamii*, its probable parents, *Q. Muhlenbergii* and *Q. macrocarpa*, and progeny of the type tree of the hybrid, from uncontrolled pollination, including median plants and others deviating strongly toward the supposed parents, as a result of segregation or secondary crossing.

	Leaves evenly dentate or sinuate-dentate.	Blades having some deep irregular lobes, with mere suggestion of terminal flabelliform segment.	Blades with deep constriction below terminal flabelliform segment.	Blades at maturity subglabrous to glabrous above, velutinous below	Blades at maturity softpubescent to glabrate above, velutinous below.	Petioles glabrous.	Petioles minutely puberulent, at least above.	Petioles thinly to conspicuously coarse-pubescent.	Persistent subulate stipules longer than terminal buds.	Bud scales subglabrous.	Bud scales ciliate and more or less pubescent.	Bud scales pilose.	Twigs of the year essentially glabrous.	Twigs of the year minutely puberulent.	Twigs of the year moderately coarse-pubescent.	Acorn cups thin-margined, not fimbriate.	Acorn cups with trace of fimbriation.	Acorn cups fimbriate.
*Q. Muhlenbergii**	+			+		+				+			+			+		
No. 12029–1	+			+		+				+			+			+		
No. 12029–2	+			+			+				+			+				
× *Q. Deamii***		+		+			+			+				+		+		
No. 9385		+		+				+	+			+			+		+	
No. 12029–3		+		+				+	+		+				+	+		
No. 12029–4			+	+				+			+				+	+		
No. 12029–5			+	+			+		+		+			+		+		
No. 12029–6			+		+			+	+			+			+			
*Q. macrocarpa****			+	+				+	+		+				+			+

* A specimen from Wells County (Deam, *s. n.*) collected on Oct. 4, 1904 for comparison with type material of the hybrid, collected a few days later by Mr. Williamson.

** Cotype of the hybrid collected Oct. 9, 1904 by E. B. Williamson (in Herb. Univ. Mich.).

*** A specimen from Ann Arbor, Michigan, collected by H. H. Bartlett (tree spontaneous in the Botanical Gardens).

are considered to have arisen by true hybrid segregation from × *Q. Deamii*, for the chestnut-oak parent is so scarce in Wells County as to make it seem hardly probable that it would have contributed the pollen for a new cross with × *Q. Deamii*. On the contrary, it would seem logical to interpret seedlings deviating toward *Q. Muhlenbergii* to be segregates rather than back-crosses.

Other seedlings, deviating toward *Quercus macrocarpa*, might logically be interpreted as new hybrids between × *Q. Deamii* and *Q. macrocarpa*, if there were any real evidence that *Q. alba* had been one of the parents of the original hybrid, but there is no such evidence. Nevertheless it must be admitted that the evidence does not conclusively rule out *Q. alba* as having been the other parent.

So far as Mr. Williamson's herbarium material of Oct. 9, 1904 indicates, the parentage of × *Q Deamii* might well have been as originally indicated. The four to six lateral lobes of the leaves, however, are actually but not conspicuously grouped above a vague constriction into a terminal flabelliform group, only a weak imitation of the condition in *Quercus macrocarpa*. There are a few duplex lobes containing two secondary veins or a single secondary with one or two downwardly directed tertiaries. Such lobes are indeed strongly characteristic of *Q. alba*, but may be found in *Q. macrocarpa* as well. Even the strong approach of seedlings to *Q. macrocarpa* need not certainly indicate that *Q. alba* was not more remotely an ancestor.

The pubescence of the hybrid and all of the seedlings cannot be held to rule out *Q. alba*. The latter is the only almost consistently glabrous white oak of the region, so it might be argued that some of the seedlings should be glabrous by segregation or back-crossing if *Q. alba* were involved. The progeny is too small for negative evidence to have any value, and might have no genetic validity anyway, in view of the fact that interacting factors for pubescence are indicated by one of the seedlings being more pubescent than any presumptive parent. So the unestablished parent of × *Q. Deamii* might as well be another markedly pubescent one, even though *Q. alba* may carry genes for pubescence which would be activated in a hybrid by interacting factors, or perhaps by dilution of the effect of inhibiting factors.

Although *Quercus alba* tends to be consistently glabrous, pubescent sprout leaves often show that factors for pubescence are present, but suppressed under the physiological conditions that result in the normal foliage of mature growth.

Among his Indiana specimens of *Quercus alba* Deam mentions only one that is pubescent. (It might be a hybrid with *Q. bicolor*.) It is on the whole not much of an argument that the small number of seedlings show none resembling *Q. alba* in having essentially glabrous leaves. Interacting factors of even two glabrous types might give pubescence. For what the argument is worth, there is one seedling of × *Q. Deamii* that has some mature leaves velutinous above as well as below. It would explain this fact most simply, in view of the close approach of some seedlings to the leaf form of *Q. macrocarpa*, and a suggestion of such form in the original hybrid, if *Q. macrocarpa* was tentatively taken to be the presumptive other parent of × *Q. Deamii*, which would then be *Q. Muhlenbergii* × *Q. macrocarpa*.

The argument, however, cannot be considered, *a priori*, as genetically sound. An isolated hybrid, primary or of a later generation, might have been so nearly self-sterile as to be only partly self-pollinated, and partly cross-pollinated by other species. So a primary hybrid *Q. Muhlenbergii* × *alba* might have set some fruits by self-pollination, and thus segregated toward the scarce or sporadically occurring *Q. Muhlenbergii*, but might at the same time have set other fruits by hybridization with *Q. macrocarpa*, producing a new hybrid resembling the latter, except in lack of the fimbriate acorn fringe, which is probably recessive or nearly so. Certainly *Quercus macrocarpa* is primarily or secondarily involved in the ancestry of those seedlings in which the leaves show the form so characteristic of the bur oak, a flabellately lobed terminal segment above a narrow constriction that occurs below the middle of the lamina and extends in extreme variates practically to the midvein.

It is to be feared that knowledge of oak genetics will grow with surpassing slowness. In the meantime, lacking precise knowledge of the parentage of hybrids, we should prefer the simplest hypotheses that seem to account for the facts. Since there is no single feature of the original tree or of the progeny of × *Quercus Deamii* that supports the hypothesis that it was *Q. Muhlenbergii*

× *Q. alba* rather than *Q. Muhlenbergii* × *Q. macrocarpa*, the latter hypothesis seems the more likely, for it explains all the known facts and is simpler. A cytological examination of the hybrids and their possible parents would perhaps throw light on the problem, without actually making the various hybrid combinations experimentally. The latter attack would be justified in view of the practical values that might come from plant breeding experiments in such a valuable group as the white oaks. Another experimental approach that is being neglected in such problems is the serological. Findings might, indeed, be negative, but differences among the proteins of such different and ancient lines of descent as those of *Q. alba*, *Q. Muhlenbergii* and *Q. macrocarpa* might be expected to be revealed by serological experimentation, and might help in indicating the course of evolution of plants which could not be subjected to rigorous genetical study except at altogether prohibitive expense. The white oaks, to be sure, are economically so important as to justify the attention of practical plant breeders.

The isolated hybrid oaks, to which systematists call attention, are by no means unworthy of the attention they receive. They demonstrate the possibility of wide interspecific hybridization, and the systematist cannot be unmindful of the genetic diversity between regional populations of what are considered wide-ranging species that may be caused by opportunity for hybridization in different parts of a broad range with entirely different species. Segregates from crosses and back-crosses doubtless produce blending populations that are geographically distinguishable. Some localized species may become so blended that original forms can only appear as segregates from a hybrid population. The interpretation of an aberrant or hybrid oak without experimental evidence is as difficult as guessing at the racial origin of human traits in a mixed population. The world flora, however, contains many thousands of species that are ill-adapted to genetical study. Many cannot be or never will be subjected to experimental breeding, and it will remain the obvious function of the systematist in the future as in the past to classify as best he can, making such use of genetical or other experimental findings as may seem applicable by analogy.

Annotated Bibliography

1. Britton, N. L. and Shafer, J. A. North American Trees. New York, 1908.

Here there is no discussion of white-oak hybrids but only a vague reference under *Q. alba* to a hybrid with *Q. Muhlenbergii* from Missouri and Illinois. Presumably the allusions are to Bush (2) and Sargent (12).

Reference to this work by Trelease (15) precedes the one to Deam's publication (3) and obscures Trelease's intention regarding typification of *Q. Deamii*. Although Trelease made a great point that stability of nomenclature would be assured by binomial names for hybrids, he was singularly uncritical about the designation of types. His binomial names must be typified by guess as to his intentions.

2. Bush, B. F. Hybrid oaks in western Missouri. Garden & Forest **8:** 32–33. 1895.

Reports, (1) *Q. alba* × *Q. macrocarpa* from Courtney, Jackson County, Missouri, with foliage of *Q. macrocarpa* and fruit plainly that of *Q. alba;* (2) *Q. alba* × *Q. Muhlenbergii*, clearly of the indicated parentage, but, according to Britton, "the fruit was exactly of the eastern *Q. Prinus*," i. e., *Q. montana;* (3) *Q. alba* × *Muhlenbergii;* (4) *Q. macrocarpa* × *Q. Muhlenbergii*, from Independence, Missouri, with no fringe on the acorn cup; (5) *Q. macrocarpa* × *Q. bicolor*, several trees in a grove of *Q. bicolor* where *Q. macrocarpa* was not present. Every mention of the acorn cup verifies the other evidence that the presence of a fringe on the acorn cup is recessive.

3. Deam, Charles C. Trees of Indiana. *In*, State of Indiana, 11th Annual Report of the State Board of Forestry, 1911. Indianapolis, 1912 (pp. 86–372).

Contains the original description and drawing of the hybrid *Q. Muhlenbergii* × *macrocarpa* upon which Trelease (15; 16) is assumed to have based × *Quercus Deamii*, although he made no reference to Deam's description and cited no specimen in the earlier of the two publications (15).

4. Deam, Charles C. Trees of Indiana (First revised edition). Department of Conservation, State of Indiana (Indianapolis) 1921.

Description and illustration of *Quercus alba* × *Mulhenbergii* (× *Quercus Deamii* Trelease). "This rare hybrid . . . in 1918 bore a heavy crop of seed. A liberal quantity was sent for propagation to the Arnold Arboretum, New York Botanical Gardens, and Missouri Botanical Gardens. The Arboretum succeeded in germinating several seed. The New York Gardens succeeded in getting five seedlings. The Missouri Gardens

failed to get any to germinate. About a gallon of seeds was planted in the Clark County State forest nursery and all failed."

5. Deam, Charles C. Flora of Indiana. Department of Conservation, Division of Forestry, Indianapolis, 1940.

In addition to the information on × *Q. Deamii* Trelease, this flora has a reference to × *Q. Hillii*, of which a single Indiana tree, as reported by Sargent, was found by Hill near Roby, Indiana, and supposed to be *Q. macrocarpa* × *Q. Muhlenbergii*. Deam states: "I have a duplicate specimen but I believe it is only a specimen of the bur oak. I question the determination of this specimen because the last named parent of the hybrid does not occur there, or, if it does, is extremely rare."

6. Engelmann, George. About the oaks of the United States. Trans. St. Louis Acad. Sci. **3:** 372–384. 1876. 385–400. 1877. 539–543. 1877.

Engelmann, the most discriminating student of the oaks in his day, stated (pp. 397–398): "All the supposed hybrids are abundantly fertile . . The seedlings of such questionable individuals do not seem to revert to a supposed parent, a sport of which they might be claimed to be, but propagate the individual peculiarities of the parent; 'come true,' as the nurserymen express it. For how many generations this may continue, and whether in time forms approaching one or the other parent may not appear, remains to be seen. At the same time it is a remarkable fact, that, notwithstanding their fertility, they do not seem to propagate in their native woods; we may properly ascribe this to a lesser degree of vitality in the hybrid progeny, which causes them to be crowded out in the struggle for existence: one of the provisions of nature to keep the species distinct, or, as Dr. Gray suggests, fertilization by one of the parents may soon extinguish the hybrid characters. I find ten forms . . . which I consider as real hybrids; of them only a few, often only single individuals have become known. Their existence cannot well, without straining facts, be considered due to innate variability in the supposed parents . . . Among the White-oaks hybrids seem to be much rarer than among the Black-oaks, or it may be that they are more difficult to discover."

Engelmann's belief that the interspecific hybrid oaks "bred true" although with a greater range of variation than non-hybrids, seems to have been based upon nurserymen's experience with two black-oak hybrids. One of them, his own discovery 8 miles west of St. Louis, was *Q. imbricaria* × *Q. palustris*. He said: "It had, unfortunately, to give way to a railroad track, but ripe fruit was obtained which to Mr. Meehan of Germantown has furnished fine young plants, completely agreeing in character with the parent." The other was × *Q. heterophylla* Michx. discovered near Philadelphia by Bartram. Even in Michaux's time the original tree had been destroyed, but, as Engelmann said (p. 541) "its offspring was introduced into Europe, and the trees now seen in Bartram's

Explanation of Plates

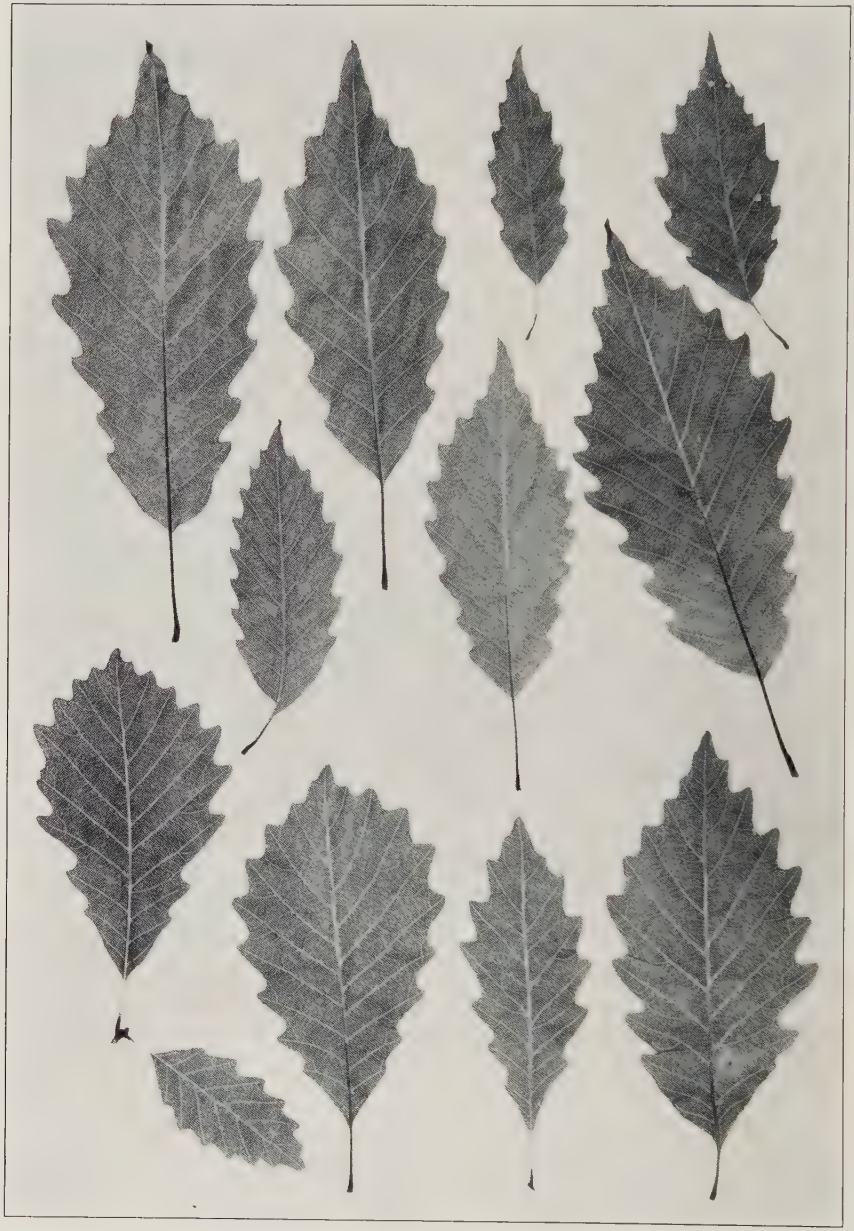
Plate 1176. Progeny of type tree of × *Quercus Deamii*. Upper 7 leaves: range of variation in the segregate most resembling *Q. Muhlenbergii* (Mich. Bot. Gard., No. 12029–1). The lateral veins have no irregularity of branching, each leading to a tooth. The acorns have no fringe, and the peduncles are less than 1 cm. long. Lower 5 leaves: the other segregate showing regression toward *Q. Muhlenbergii* (No. 12029–2). Leaves relatively broader; lateral veins with one or two upward or downward branches of irregular strength, or sometimes a fork from the midvein, directed toward the sinuses. Rarely an independent but weaker lateral vein reaches a sinus.

Plate 1177. × *Quercus Deamii*. Specimen of the original collection by E. B. Williamson, 9 Oct. 1904, from the type tree near Bluffton, Indiana (Herb. Univ. Mich.). This represents a degree of intermediacy between *Q. Muhlenbergii* and *Q. macrocarpa* that less resembles the former than do the specimens shown in Plate 1. It is perhaps nearer *Q. Muhlenbergii* than *Q. macrocarpa*, and entirely destitute of the acorn-cup fringe characteristic of the latter.

Plate 1178. Progeny of type tree of × *Quercus Deamii*. The oldest seedling (from acorn crop of 1918) at Mich. Bot. Gard. (No. 9385). The leaf form distinctly shows regression to *Q. macrophylla*, but the constriction below the flabelliform terminal part of the leaf is not deep enough to be typical. The terminal group of crenations are served by lateral veins, and the branches of the latter to the sinuses are extremely weak. The deep sinuses of the lower part of the leaf are mostly served by independent laterals, bifurcated below the sinus. The irregular deep median and lower leaf lobes are often entered by two lateral veins, which have one or two strong branches or are forked. The acorn cups are not fringed from most of the marginal scales, but only weakly from a few.

Plate 1179. Progeny of × *Quercus Deamii*. Upper 6 leaves from a seedling (No. 12029–3) showing definite regression toward *Q. macrocarpa*. Lower four leaves (from seedling no. 12029–4) show even more definite regression toward *Q. macrocarpa* but the young acorns have *no* cup fringe. For this important characteristic there is apparently independent segregation. The peduncles are about 2 cm. long.

Plate 1180. Progeny of × *Quercus Deamii*. Upper 3 leaves (no. 12029–5) show forms which would indicate complete regression of the hybrid to *Q. macrocarpa* if it were not for the contradictory characteristics of the acorn. The young acorn cup lacks a fringe, and thus resembles that of *Q. Muhlenbergii*. The peduncles range from 2 to 16 mm. in length. Lower 4 leaves: the smallest of the seedlings, perhaps a half-dwarf, showing pronounced resemblance in leaf form to *Q. macrocarpa*, but a greater tendency to retain velutinous pubescence on the upper leaf surface. This may possibly be a juvenile characteristic retained because of shading and suppression of growth by companion trees in the same group.



garden in West Philadelphia, at Marshall's place in Marshalltown, and in J. Hoopes' garden in Westchester, as well as those of the European gardens at Verrière, Herrnhausen and Prague, the latter fertile, are believed to be its seedlings. Only within the last ten or fifteen years the tree has been rediscovered, and now numbers of individuals are known in low woods on both sides of the Delaware below Philadelphia . . . often in groups together, probably the offspring of some few original hybrid trees."

7. Hampton, W. C. Descriptive list of the oaks of Hardin County, Ohio. *In* First Annual Report, Ohio State Forestry Bureau . . . for 1885. Columbus, 1886 (pp. 193–195).

Contains brief and amateurish but nevertheless significant descriptions of several newly proposed oaks which botanists have generally disregarded, most of them varieties of *Q. macrocarpa.* Under var. *monstrosa* we find an interesting comment: "Some specimens have the mossy filaments incurved as in *Q. Fisherii* [which he described as *macrocarpa* var. *Fisherii*]; this is evidently a hybrid of *Q. macrocarpa* with some other oak, perhaps *Q. lyrata*, which may have existed here at some former period."

8. Hitchcock, A. S. Another hybrid oak. Bot. Gaz. **18:** 110–111. 1893.

The original description of the hybrid *Q. macrocarpa* × *Muhlenbergii* Hitchcock, which was binomially named × *Q. Hillii* Trelease, as a *nomen nudum* in 1917 (15) and effectively in 1924 (16), the name indicating Hill's specimen from Roby, Indiana, as the type, rather than Hitchcock's from Manhattan, Kansas. The latter was indicated originally as *Q. macrocarpa* × *prinoides* var. *Muhlenbergii* because Hitchcock did not believe that *Q. Muhlenbergii* could be distinguished specifically from *Q. prinoides* in Kansas. Hitchcock made no reference to Hill, and believed his record of the hybrid to be the first. The parentage was attributed with certainty, for only two kinds of white oaks (except the rare hybrid, of which two trees were found) grow near Manhattan. One of the two had acorn cups "showing a tendency to be mossy fringed" (but very obscurely so, according to the plate) whereas the other had them "decidedly mossy fringed, as in *Q. macrocarpa.*" Both may have been segregates or back-crosses of the original hybrid.

9. James, J. F. On the variability of the acorns of *Quercus macrocarpa* Michx. Journ. Cincinnati Soc. Nat. Hist. **4:** 320–322, 1 pl. 1881.

James called attention to the fact that no other East-American oak (he studied them especially around Cincinnati) has the scales at the edge of the acorn cup prolonged as thread-like appendages, forming a fringe. He regarded the fringe as possibly a new characteristic in the evolution of oak species, pointing to its extreme variability, but disregarded species

with fringed cups which occur in Asia and Europe, which of course vitiates his argument. It seems, from the facts that the fringe appendages are suppressed in the original × *Q. Deamii*, do not show in the seedlings deviating toward *Q. Muhlenbergii*, and are only very feebly developed in one of the two seedlings thus far fertile that deviate towards *Q. macrocarpa*, that the development of the fringe is inhibited by some factor contributed by *Q. Muhlenbergii* which is not linked with the chief factors for leaf form. James thought that *Q. macrocarpa* might possibly demonstrate evolution of a new group of species differing partially in varying expression of the fringe, from none at all to a very conspicuous one. Of course the individuals that he considered as *Q. macrocarpa* without fringe may have been of hybrid origin, or may even have been forms of *Q. lyrata* misidentified. In this connection it is interesting to observe that × *Q. Bebbiana* (= *Q. macrocarpa* × *alba* Engelm.) is described as having fruits similar to those of *Q. bicolor*, which presumably means that the fringe is suppressed. Rehder (11) says definitely "cup scarcely fringed." Still, the conception of the fringe as a new departure in evolution is an intriguing one. If it should prove to be recessive in all first-generation hybrids between *Q. macrocarpa* and other species, its suppression may afford a good criterion for the recognition of hybrids. If the original tree of × *Q. Deamii* is a first generation hybrid, then the fringe is recessive in at least this one combination. Whether the seedlings that deviate toward *Q. macrocarpa* are segregates or back-crosses, some gametic combinations have complete and others almost complete suppression of the fringe.

10. Macdougall, D. T. Hybridization of wild plants. Bot. Gaz. **43**: 45–58. 1907.

MacDougall had three cultures totalling over 100 seedlings of × *Quercus Rudkini* Britton (reputed to be *Q. marilandica* × *Q. Phellos*) under observation for a year. They were grown from three parents selected for their dissimilarity. The three progenies were fairly identical. Although a wide range of variability was found, it "did not exceed the limits of similar fluctuations offered by other species of oaks which are known to be unified hereditary strains." On the contrary his cultures of *Quercus heterophylla* which inadequate early tests had apparently shown to breed true, showed a wide range of segregation from *Quercus Phellos* to *Q. rubra* (in the more familiar sense, i. e., *Q. borealis* var. *maxima*, not *Q. falcata*).

11. Rehder, Alfred. Manual of Cultivated Trees and Shrubs. New York, 1934.

Of × *Quercus Schuettei* Trel. (*Q. bicolor* × *macrocarpa*) he says: "cup sometimes short-fringed," from which one is presumably to infer that sometimes it is not fringed at all.

12. Sargent, C. S. Silva of North America, Vol. VIII. Boston & New York, 1895.

Sargent recognized three hybrids involving *Q. macrocarpa*, as follows:

Q. macrocarpa × *alba* (= *Q. Bebbiana* Schneider)
Q. macrocarpa × *Muhlenbergii* (= *Q. Hillii* Trel.)
Q. macrocarpa × *bicolor* (= *Q. Schuettei* Trel.)

As to acorn fringe, the first tree of *Q. Bebbiana*, discovered by M. S. Bebb near Fountaindale, Ill., appears to have had none. Another specimen of the same, found at Athens, Ill., by Elihu Hall, was "destitute of marginal, fringe-like scales." A third, found by C. G. Pringle at Charlotte, Vermont, had good acorns, and a progeny was grown at the Arnold Arboretum. In the original tree "the cups were entirely destitute of marginal fringe."

13. Sargent, C. S. Manual of the Trees of North America (exclusive of Mexico). 2d ed. Boston & New York, 1922.

"× *Quercus Deamii* Trel. with characters intermediate between those of *Q. alba* and *Q. Muhlenbergii* and evidently a hybrid of these species, is growing near Bluffton, Wells County, Indiana."

"× *Quercus Hillii* Trel., believed to be a hybrid of *Quercus macrocarpa* and *Q. Muhlenbergii*, has been found at Roby, Lake County, Indiana, and near Independence, Jackson County, Missouri."

14. Sudworth, G. B. Hybrid oaks. Amer. Forestry 23: 683–685. 1917.

Mr. Sudworth came to the conclusion soon after the discovery of the Deam oak that it was *Q. acuminata* (= *Q. Muhlenbergii*) × *Q. alba*, but, curiously enough, does not refer to it in this article which contains "a list of the hybrid oaks discovered in the United States during the last hundred years." He remarked: "The determination of what parent species of oaks have produced the various hybrids now known is a matter entirely of recognizing the distinguishing characteristics of the parents as exhibited in the hybrid. No one is prepared to prove the supposed parentage of any of the hybrid oaks . . . So far, no one appears to have tried artificially to reproduce any of these hybrid forms by cross-fertilization of their supposed parents." (*Q. Comptonae* Sarg. might have been mentioned as an exception. This spontaneous hybrid was duplicated by Ness through pollination of *Q. virginiana* by *Q. lyrata*.)

15. Trelease, Wm. Naming American hybrid oaks. Proc. Amer. Phil. Soc. 56: 44–52. 1917.

Trelease justified giving binomial names to the oak hybrids as follows: "A binomial applied to a hybrid at once falls under the procedure customary with ordinary specific binomials, and no matter what changes the

trivial names of the parent species may undergo its own applicability rests solely on the basis of priority." Accordingly Trelease here gives binomial names to all the better attested American hybrid oaks, mostly (as in the instances of *Q. Deamii* and *Q. Hillii*) without descriptions, reference to previous literature, or citation of specimens. Actual valid establishment of most of the new names in this article would date, in event of any question of priority arising, from the following work of 1924.

16. Trelease, Wm. The American Oaks. Mem. Nat. Acad. Sci. XX. Washington, 1924.

In his key to the *Albae* which indicates the characteristics of some of the other known or supposed hybrids with *Q. alba,* × *Q. Deamii* is not included. Instead it is placed with the chestnut oaks (Prinoideae). × *Q. Hillii* is to be found in the key to the Macrocarpae, (p. 107) but Trelease apparently doubts the parentage, for he refers to it as a "supposed hybrid" between *Q. macrocarpa* and *Q. Muehlenbergii.* (Incidentally, he insists upon preserving the "e" that Engelmann put into Muhlenberg's name to represent the umlaut u, although Muhlenberg himself spelled his name with no umlaut. It would appear that the commonly accepted spelling, with u instead of ue, should continue to be preferred.)

SPECIES NEWLY OR RARELY REPORTED FROM NOVA SCOTIA AND CAPE BRETON ISLAND

D. S. Erskine

The publication of Roland's "Flora of Nova Scotia" in 1944–5, by providing a point of reference, and the funds made available for research in the brief interval between "outbreaks of mutual defence," have recently given impetus to the botanical exploration of this province. Most of the collections reported were made in connection with a forest ecology survey, financed by the Nova Scotia Research Foundation, by successive summer parties of students led by Dr. E. C. Smith of Acadia University. Collections made by the same parties on Brier Island with Dr. A. E. Roland are to be reported elsewhere. Also excluded are some collections of introduced plants as yet uncertainly identified.

Although the following records are based primarily on the specimens in the Acadia University herbarium,[1] these in some cases are duplicates of collections which were made for other

[1] Thanks are expressed to the members of the Biology Department for making this collection freely available.

botanical institutions. I wish to thank Dr. Roland for reading the manuscript while it was being prepared and for the records based on his collections made for the herbarium of the Agricultural College at Debert; Dr. W. G. Dore, for placing at my disposal unpublished notes on grasses, based on his and Eville Gorham's collections made for the herbarium of the Dominion Experimental Farm at Ottawa; Dr. H. P. Bell, for looking up in the Dalhousie University herbarium the data for certain records; and Miss M. S. Brown, for permission to report her recent discoveries. I am indebted to Dr. Smith and to J. S. Erskine for their continuing advice and collaboration.

Asplenium viride Huds. Cumberland Co.: rock crevices, two miles above Jeffers Falls Crossroads, *C. J. Bishop & I. V. Hall*, July 1, 1949. This collection would seem to reinstate MacKay's old record from Moose River, Cumberland Co., and confirms its presence on the mainland of the province. A third Cape Breton collection may be added to the fifty-year old records of Macoun and C. B. Robinson, also in Inverness Co.: mossy cliffs below the waterfall, south branch of Grand Anse Brook, Pleasant Bay, *E. C. Smith, D. S. Erskine, D. R. Sampson & F. C. Bent 4056.*

Woodwardia virginica (L.) Sm. Inverness Co.: very abundant in sphagnum-black spruce swamp, West Lake Ainslie, *E. C. Smith, D. S. Erskine, E. H. Collins & W. B. Schofield 1191*[2]*; E. C. Smith, E. H. Collins, J. M. Bruce, D. R. Sampson & F. C. Bent 3856.* The northeastern range-limit of this species is extended from Pictou to Cape Breton Island. The following collection in the herbarium of Dr. G. C. Warren (recently donated to Acadia University)—Prince Edward Island: Southport, Queens Co., *Smallwood*, Sept. 1903—confirms Roland's report from that province (Proc. N. S. Inst. Sci. *20* (3): 77), omitted from the range given in his Flora and in the eighth edition of Gray's Manual.

Potamogeton amplifolius Tuckerm. Inverness Co.: slow water, Au Coin Brook, Cheticamp, *SECS 1149.* Local range extended northeastward in the province from Kings Co. to Cape Breton.

P. praelongus Wulf. Inverness Co.: Pembroke Lake, *D. A. Livingstone*, Aug. 22, 1949. This is the first Cape Breton station for this species, which has, according to Dr. Roland, been found abundant at the one old station (MacKay's in Earltown Lakes) by various recent collectors, and occurs also in Kings Co.: Cornwallis River above Kentville, *J. P. Kelsall*, June 1946.

Sagittaria latifolia Willd. Inverness Co.: pond behind beach, Margaree Harbour, *SECS 1146.* The northeastern range-limit is extended to Cape Breton by this collection of the forma *gracilis* (Pursh) Robinson.

Sagittaria cuneata Sheldon. Inverness Co.: muddy pond edge, Cheticamp, *E. C. Smith, E. H. Collins, J. M. Bruce & D. R. Sampson 2777;* muddy shallows of garbage-strewn lake, Le Grand Lac, Grand Etang, *D. A. Livingstone*, Aug. 22, 1949; in brook near beach, Margaree Harbour, *SECS 1145;* upright in mud, stream at Hayes River, *SCBSB 3891*, leaves floating, *3892;*

[2] Collections of the forest ecology party of 1948 are subsequently designated by the initials *SECS*, the collections of 1949 by *SCBS*, and those of 1950, *SCBSB*.

Victoria Co.; muddy borders of pond, South Gut St. Ann's, *SECS 894.* The northeastern limit is extended from Pictou to Cape Breton, where this seems the common species of the genus.

Elodea canadensis Michx. (*Anacharis* Planch.) Colchester Co.: in an artificial pond, Debert, *SECS 136.* This first station for the province was discovered and indicated to us by Dr. Roland. Since the pond is frequented by waterfowl and a prospective sanctuary, it seems possible that this recent introduction was intentional or accompanied an unsuccessful introduction of wild rice.

Briza media L. Hants Co.: abundantly naturalized in grass around Kings College School, Windsor, *D. S. Erskine,* June 18, 1951. The only previous report from the province was Macoun's from Digby forty years ago. The new Manual does not indicate the naturalization of this species in the Maritime Provinces.

Lolium multiflorum Lam. Halifax Co.: ballast, Halifax, *E. Gorham 45. 1319B.* "The Italian rye-grass, which differs from *L. perenne* in the presence of awns on the lemmas and in the rolled leaves, was collected in admixture with the latter on ballast at Halifax. This adds another species to the introduced grass flora of Nova Scotia"—Dore, ms.

Deschampsia cespitosa (L.) Beauv., var. **parviflora** (Thuill.) Richter. Colchester Co.: by railroad tracks, Stewiacke, *A. E. Roland & W. G. Dore 45.1003;* Pictou Co.: by fair grounds, New Glasgow, *W. G. Dore & E. Gorham 45.459.* "This variety is a European plant introduced in certain localities in New England, but not formerly reported for Canada. It is so different from our native var. *glauca* (Hartm.) Lindm. in its tall stature, ample panicle and basal tufts of stiff coarse leaves that it is readily separated. It grows in dry open sites by towns and cities rather than on the moist gravelly shores of lakes and streams, which further marks it as adventive. The three widely separated points where it was collected in 1945 represent independent introductions (a third station was found at Saint John, N. B., *W. G. Dore & E. Gorham 45.933*)"—W. G. Dore, ms.

Calamagrostis neglecta (Ehrh.) Gaertn., Mey. & Scherb. (det. W. G. Dore) Victoria Co.: larch bog, Big Baddeck, *SECS 1059.* This collection, first from Cape Breton, is the third from the province, the second being that reported from Beaver Lake, Yarmouth Co., by Louis-Marie in Rhodora *46:* 297–8. 1944.

Agrostis canina L. Pictou Co.: old field near New Glasgow, *H. A. Senn, W. G. Dore & E. Gorham 45.476;* a report for Halifax Co.: Prospect Road (Dore, in litt.). Since the presence of this species on the mainland was not indicated by Dore and Roland (Proc. N. S. Inst. Sci. *20* (4): 247. 1942), it seems desirable to include it in this paper. With the typical plants at New Glasgow collections were also made from clones lacking purple coloration, a form for which Dore finds the name var. *varians* Asch. & Graebn. available (*Senn, Dore & Gorham 45.477*).

Alopecurus aequalis Sobol. (*A. aristulatus* Michx.) Inverness Co.: pond edge, Kenloch (Strathlorne Station), *SECS 1195.* Although reported from Margaree Harbour by Roland (Can. Field Nat. *52:* 106. 1938), no Cape Breton stations are shown on the distribution map in Dore and Roland's Grasses.

Muhlenbergia glomerata (Willd.) Trin. Inverness Co.: bog, Loch Ban, Lake Ainslie, *M. S. Brown,* Aug. 15, 1944 (more or less typical); bog at head of MacGregor Brook, North Aspy River, *SECS 1163* (var. *cinnoides* (Link)

Hermann, det. W. G. Dore). As appears from the distribution map in Dore and Roland's Grasses (p. 256, sub *M. racemosa*), and from Dore's annotation on our collection, these constitute the first report from Cape Breton Island.

Zizania aquatica L., var. **interior** Fassett. Kings Co.: established in the Canard River, Canard, *A. E. Roland & W. G. Dore 3078*, Aug. 11. 1942. It has persisted at this station since then, and probably since the 1939 collection reported by Roland in Rhodora *43:* 338. 1941. This variety, which Fassett states does not range east of Indiana, was also established along the tidal banks of the Saint John River at Sheffield, N. B. (*W. G. Dore 2218*). "Both these are probably artificial establishments resulting from the attempts of sportsmen to encourage its growth to attract wildfowl"—Dore, ms. The var. *angustifolia* Hitchc. appears to have been introduced at the Long Lake station near Amherst, and has been found similarly at Port Hood, Inverness Co.—Dore, in litt.

Cyperus filiculmis Vahl. Antigonish Co.: sand behind beach, Pomquet, *W. G. Dore 1585*, July 20. 1940. An extension of range from Maine if, as seems likely, these immature plants belong to the var. *macilentus* Fern.

Carex prairea Dewey. (*C. diandra*, var. *ramosa* (Boott) Fern.). Kings Co.: in standing water of *Typha* swamp, Centreville, *David Erskine 938*.

C. atratiformis Britton. Victoria Co.: rock crevices, Salmon River, *SCBS 2653*. A relatively northern species, new to the province.

C. capillaris L., var. **major** Blytt. Inverness Co.: crevices in rock cliff, South Blair River, *SCBSB 3798*. Widely distributed in New Brunswick, but new to Nova Scotia.

C. livida (Wahl.) Willd., var. **Grayana** (Dewey) Fern. Richmond Co.: bog by Point Michaud road, *SECS 771*. This new collection from the same general area as the Louisburg report of Macoun appears to reinstate the species in the flora of Nova Scotia.

C. plantaginea Lam. Colchester Co.: hardwood hillside, Brookside, *A. E. Roland* May 20, June 20, 1951. This spring-flowering sedge has been reported for the Maritimes only from western New Brunswick.

C. hystricina Muhl. Kings Co.: swale along brook, North Mountain above Delhaven, *David Erskine 742;* Arlington, *G. C. Warren*, June 8, 1944; abundant in swamp north of Cornwallis River, Cambridge, *W. B. Schofield 56*. Nova Scotian records were needed to complete the range of this species in eastern Canada. In his Flora, Roland reports *C. lurida*, var. *gracilis* (Boott) Bailey as present in central Nova Scotia; from the description this may well refer to *C. hystricina*.

Lemna trisulca L. Inverness Co.: shallow water in cat-tail marsh by bridge, Scotsville, *A. E. Roland 686*, Aug. 25, 1950; Victoria Co.: slow-flowing stream, Baddeck Bridge, *SECS 1041*. These are the first collections from Cape Breton Island, but constitute only a slight eastward extension of range from Prince Edward Island and the Magdalens.

Juncus compressus Jacq. Inverness Co.: bog, North East Mabou, *SCBS 2817;* Richmond Co.: poorly drained sand by canal, St. Peter's, *A. E. Roland 666*, Sept. 8, 1950. These new records from the province are the first from Cape Breton, Rousseau's from Guysborough being the one previous, and the stations are, on the whole, consistent with the restriction of its eastern range in Canada to the Gulf of St. Lawrence area.

J. Dudleyi Wieg. Inverness Co.: wet meadow, Cheticamp, *SCBSB 3668*. New to Cape Breton, but found in Prince Edward Island. The only Nova Scotian record is of Long's collection from Middleton.

J. stygius L., var. **americanus** Buchenau. Inverness Co.: bog at head of MacGregor Brook, North Aspy River, *SCBS 2768.* The only collection known to Roland was Allen's from Isle Madame, made seventy years ago.

Luzula parviflora (Ehrh.) Desv., var. **melanocarpa** (Michx.) Buchenau. Cumberland Co.: woods road, Three Sisters, *SCBSB 3132,* new to mainland Nova Scotia and intermediate between the Strait of Canso and New Brunswick, an apparent gap in the ranges of several species which could perhaps be filled in for others—as it has been for *Solidago macrophylla* Pursh, collected at Moose Lake, Colchester Co., (*Smith, Collins & Schofield 1208*).

Sisyrinchium angustifolium Mill., sensu Fern. (*S. graminoides* Bickn.) Richmond Co.: wet gravelly border of McIntyre's Lake, *A. E. Roland 669,* Sept. 8, 1950. Although scattered from Yarmouth to Guysborough Co., this species has not been reported from Cape Breton.

Habenaria flava (L.) R. Br., var. **herbiola** (R. Br.) Ames & Correll. Annapolis Co.: field, Kemp's farm, Middleton, *Eric Hockey,* July 10, 1938; Kings Co.: low ground by river, Gaspereau, *J. S. & D. Erskine 160;* Inverness Co.: Cheticamp, *SCBSB 3650.* Hitherto known in Nova Scotia only by one collection from Guysborough Co., this variety seems to be general though local in the northern counties.

Scleranthus annuus L., listed by Roland as one to be expected in Nova Scotia, was reported by H. Groh in Canadian Weed Survey, Fourth Report, 1945, p. 14, from Kings Co.: Waterville (coll. Buchanan, 1940); since collected from the railroad at Windsor, Hants Co.: *J. S. Erskine 50.991* (in Provincial Museum of Science).

Stellaria Holostea L. Kings Co.: field below road, Starrs Point, *J. S. Erskine,* June 3, 1951. This seems rather a rare introduction, being the first record for the Maritime Provinces.

S. humifusa Rottb. Guysborough Co.: salt meadow, Marie Joseph, *SECS 625.* This seems to be the first station on the Nova Scotian mainland.

Brasenia Schreberi Gmel. Victoria Co.: pond, Middle Aspy River, Cape North, *SECS 1083.* This first Cape Breton Station seems to be the northeastern range limit of the species.

Ranunculus sceleratus L. Halifax Co.: damp roadside, Barrie Beach, *H. P. Bell,* July 18, 1935; *Jean W. McLellan,* July 21, 1937; sand beside brackish pond, Eastern Passage, *J. S. Erskine,* July 13, 1949; *H. P. Bell, A. Gorham, & J. S. Erskine,* July 21, 1949 (Station discovered by *M. S. Brown*). Although reported for the Nova Scotian flora in the eighth edition of Gray's Manual, this species was not included in Roland's Flora. It is also found along the coast in New Brunswick.

Anemone canadensis L. Victoria Co.: meadow, Bay St. Lawrence, *SCBS 2720;* Inverness Co.: meadow at end of pond, Presqu'ile, *SCBSB 3368;* meadow, Cheticamp, *SCBSB 3658.* The presence of this species in Nova Scotia was indicated in the eighth edition of Gray's Manual, though omitted from Roland's Flora.

Tillaea aquatica L. Cape Breton Co.: muddy pond behind beach, Cataloge, *SCBS 2853,* the third collection from the province and the first from Cape Breton.

Parnassia parviflora DC. Inverness Co.: damp grassy hollows in sand dunes, West Mabou Harbour, *SCBSB 3906.* The rediscovery of this species, so long on the books for Cape Breton, was one major excitement of last summer's collecting.

Sanguisorba canadensis L. Kings Co.: moist meadow, Scott's Bay, *J. S. Erskine*, Aug. 15, 1947, a recent collection from the Nova Scotian mainland, but perhaps, as Roland suggests for the previous ones, an introduction, for so conspicuous a plant could scarcely have been overlooked by M. E. Eaton who collected there in 1938.

Robinia hispida L. Kings Co.: south of Wolfville, *L. A. West, J. Wesley & R. Harlow*, Sept. 1943. An unreported introduction, unlikely to spread far, but still persistent on the bank opposite the College's University Avenue dump.

Empetrum atropurpureum Fern. & Wieg. (det. E. C. Smith). Inverness Co.: in mats along edge of sea-bluff, Pleasant Bay, *SECS 947; SCBS 2762; SCBSB 3983*, with *E. nigrum;* Victoria Co.: sheltered edges of exposure barren, seven miles west of Neil's Harbour on "Mary Ann Trail," *SCBSB 3825*. At this station the equally rare *E. Eamesii* was also collected, from hummocks in the barren, *SCBSB 3808*. *E. atropurpureum* is new to Cape Breton, and was collected in the province only by Macoun.

Floerkea proserpinacoides Willd. Inverness Co.: forming carpets in ravine hardwoods, Glenora, Mabou Highlands, *E. C. Smith, D. S. Erskine, D. R. Sampson & F. C. Bent 4016*. This station, first for Cape Breton and second for the province (see RHODORA *50:* 283. 1948), removed any possible doubt of the indigenous status of Floerkea in Nova Scotia, despite the distance beyond its generally ascribed northeastern limits.

Ilex glabra (L.) Gray. Cape Breton Co.: bog, Louisburg, *G. C. Warren*, July 28, 1938. A northeastward extension of range from Halifax to Cape Breton Island.

Hypericum majus (Gray) Britton. Victoria Co.: mossy woods road, Big Baddeck, *SECS 1065*. Some plants of the collection suggest an admixture of *H. canadense*.

Epilobium hirsutum L. Halifax Co.: beside Steele's Pond, Point Pleasant, Halifax, *J. S. Erskine*, Aug. 1, 1949. An introduced species as yet unreported from the Maritimes.

E. strictum Muhl. Antigonish Co. (so given; but apparently just across the line in Guysborough Co.): swamp three miles south of Merland, *SECS 662;* Kings Co.: swamp by main road, Hortonville, *David Erskine 757;* marsh, Habitant Creek, Sheffield Mills, *H. P. Bell, A. Gorham, J. S. Erskine, & D. Erskine*, July 14, 1950. This species, known from the Tantramar Marshes and common in Cape Breton, may now be reinstated in the mainland flora of the province.

Oenothera biennis L., var. **hirsutissima** Gray. Kings Co.: sand at foot of cliff, Starrs Point, *David Erskine 493*. A specimen from Guysborough Co.: beach, Cooks Cove, *H. G. Perry, R. H. Wetmore, G. C. Hicks & A. R. Prince 10223*, seems to belong here also. From Fernald's treatment of the subgenus *Onagra*, it would appear that *Oe. biennis*, not *Oe. muricata* which is a synonym of *Oe. parviflora* L., is the "common evening primrose" of Nova Scotia. He there reports this variety for the other Maritime Provinces only.

Zizia aurea (L.) Koch. Antigonish Co.: roadside along Pomquet River, *SCBSB 3173;* Halifax Co.: bank of stream, above Upper Musquodoboit, *SESB 4128*. An extension of range from New Brunswick.

Pimpinella Sagifraga L. Yarmouth Co.: weed, locally abundant, Pubnico, *A. E. Roland & D. Palfrey 703*, Sept. 15, 1950. For this report, first from Nova Scotia although it has long been known from the middle St. John River valley in New Brunswick, I am indebted to Dr. Roland.

Vaccinium caespitosum Michx. Kings Co.: rocky cliffs, Black River, *R. H. Wetmore*, June 12, 1920. Newly reported for the province. To M. E. Eaton goes the credit for first recognizing this specimen as a *Vaccinium*. The Prest (1905) record of *V. uliginosum* from barrens in the western and northern counties of Nova Scotia, mentioned by Roland, may well apply to this second species of the subgenus *Euvaccinium*. It is, at any rate, abundant in the Black River area, where we sought it after seeing specimens in the herbarium.

Teucrium canadense L. Richmond Co.: a patch by the bridge to Isle Madame, *A. E. Roland*, Sept. 8, 1950. This is the first record from Cape Breton, although the species was already known from both the north and south shores of the Nova Scotian mainland. The gap from Queens Co. to Richmond Co. is broken by the following collection: Halifax Co.: barrier beach, Queensland, St. Margarets Bay, *David Erskine 866*.

Origanum vulgare L. Hants Co.: covering a considerable area along the Wentworth Road, a mile west of Sweets Corner, *J. S. Erskine*, Sept. 17, 1949; *SCBSB 3998*. At this station it set no fruit and is spreading vegetatively only; first record of its establishment in the Maritimes.

Lycopus europaeus L. Halifax Co.: edge of ballast dump, Steele's Pond, Point Pleasant, Halifax, *J. S. Erskine & David Erskine*, Aug. 24, 1949. An adventive species very similar to *L. americanus*, newly recorded for the Maritimes.

Verbascum virgatum Stokes. Cape Breton Co.: in a cemetery, Sydney, *G. C. Warren*, July 1946. From the same county as Macoun's sole record, this collection indicates presence, though probably not persistence, of this species.

Cymbalaria muralis Gaertn., Mey., & Scherb. Yarmouth Co.: shady roadside, Vancouver Street, Yarmouth, *Claire Killam*, Sept. 2, 1948. This is the first report of the establishment of this introduction in Nova Scotia.

Linaria repens (L.) Mill. Kings Co.: orchard back of laundry, Acadia University, Wolfville, *L. Annis & I. MacDonald*, Oct. 13, 1944. The eighth edition of Gray's Manual settled the identification of these specimens, resolving a conflict in our concept of *L. canadensis* and providing us with a species new to Nova Scotia.

L. dalmatica (L.) Mill. Halifax Co.: roadside ditch, Hubbards, *J. S. Erskine & David Erskine 855*. We took the only specimen; therefore this second record (first from the provincial mainland see Fernald 1948) can scarcely be regarded as that of an established species.

Penstemon Digitalis (Sweet) Nutt. Kings Co.: north side of run-out field, top of Cape Blomidon, *Wilbert Spencer & Murray Zinck*, July 26, 1936. The extension of range of this species northeastward to Nova Scotia is in keeping with its weedy behavior.

Plantago indica L. (*P. arenaria* Waldst. & Kit.). Halifax Co.: railway yard, Halifax, *M. S. Brown*, Aug. 1950. The specimen, determined by Dr. Roland, and now in the Agricultural College herbarium at Debert, seems to represent the first introduction of this species to the Maritime Provinces.

Solidago hispida Muhl. Digby Co.: Sandy Cove, *R. Erskine*, Aug. 8, 1948. No stations are recorded in Roland's Flora of Nova Scotia, his one specimen having been lost in the fire.

Cotula coronopifolia L. Halifax Co.: salt marsh by sea, Prospect, *M. S. Brown*, Sept. 17, 1938; edge of brackish pond, beach at Eastern Passage, *J. S. Erskine*, July 13, 1949, *H. P. Bell, A. Gorham, & J. S. Erskine*, July 21, 1949. Known for fifty years from Prince Edward Island, and more recently collected

in New Brunswick on Grand Manan and at Lower Caraquet, Gloucester Co. (*W. G. Dore & E. Gorham, 45. 790*). This cosmopolitan species of muddy coasts was added to the flora of Nova Scotia by *M. S. Brown's* discovery of these stations.

Prenanthes racemosa Michx. Digby Co.: cliff-edge, Sandy Cove, *R. Erskine*, Aug. 8, 1948. This is the first collection of the species from the Nova Scotian mainland, but Macoun had reported it from Sydney Mines in Cape Breton.

Wolfville, Nova Scotia

New Zealand Botanists[1]—On December 5, 1642, Abel Janszoon Tasman left Anthony van Dieman's Land for the islands of Solomon. Instead of his destination thirteen days later he reached what he named Staten Land, later changed to Nova Zeelandia. But it was not for two hundred more years that New Zealand was botanically explored beyond the fringes of her three principal islands. In fact, it was not until 1853–55 that J. D. Hooker's *Flora Novae-Zealandiae* was published, the first tabulation of the plant life. Of the total of 1571 vascular plants known in 1925, three-fourths are peculiar to the islands. 366 native species are common to other regions, chiefly Australia, but 108 species are common to South America and New Zealand. How this distinctive flora was made known is the theme of this attractive little volume.

The botanical exploration of New Zealand began Friday, October 8, 1769, when Cook landed at Poverty Bay—named because of the disappointing flora that the party encountered there. For the next seventy years reconnaissance was made by the British, French and American governments climaxing with the colonization by the British in 1840. In the first period of New Zealand's botanical history were visits by Allan and Richard Cunningham, Ernst Dieffenbach, John Carne Bidwell, and briefer visits by Archibald Menzies, Dumont D'Urville, Charles Darwin, etc. Each of these explorers in Miss Glenn's book is characterized more, however, by his discoveries than by his personality. This impersonal quality is, perhaps, the weakest thread in the fabric of her writing. Put aside the book and it is hard to recall a bit of anecdote that high-lighted more than one or two of the nearly thirty persons accounted for.

It is easier to personalize the figures that fall in the second period of botanical exploration or the last one hundred and ten years. Here appear such familiar figures as J. D. Hooker, who came on the *Erebus* as surgeon and naturalist, just as Dr. David Lyall served on the companion ship, the *Terror*, to chart the "Southern Ocean" and investigate terrestrial magnetism. From Hooker and Lyall's exploration of the main Auckland and Campbell islands came the material for Hooker's classic *Flora Antarctica* (1844); illustrated with 80 plates and describing 100 species, it is notable that the collections for this work were made in less than a month! Foremost resident botanist was Rev. William Colenso, who came in 1834 in time to guide Darwin the following year when he visited the islands on the voyage of the *Beagle*. Dr. Andrew Sinclair, surgeon with the H. M. S. *Sulphur*, which visited the coast of Lower California, reached New Zealand in 1841. Sinclair collected particularly on North Island and sent fine sets of plants to Kew. Unfortunately he was

[1] *Botanical explorers of New Zealand.* By Rewa Glenn. A. H. & A. W. Reed, Wellington, N. Z., pp. 176, *6 plates, frontispiece in color*, 1950. 13s. 2d.

drowned in 1861 when fording the Rangitata River before he published any important paper on the island flora. Then follow David Monro, physician, sheep rancher, magistrate, who was knighted by Queen Victoria; W. T. L. Travers, Lieutenant, barrister, and his son Henry, both field collectors; the geologist Julius von Haast, who named the Franz Josef Glacier and for whom Hooker named the cushion composite genus *Haastia* of the "Southern Alps." James Hector, geologist in both Canada and New Zealand, and director of the New Zealand Institute, falls in this period. Better known to us is the forester Thomas Kirk, author of the *Forest Flora of New Zealand*, lecturer at Wellington College and the principal writer on forestry in the islands. Foremost of New Zealand botanists for field exploration and for the extent of his writings is Leonard Cockayne. Finally there is the museum curator, founder of a field naturalists' club, and author of the comprehensive *Manual of the New Zealand Flora* (ed. 2, 1925), T. F. Cheeseman. These essentially contemporary figures are more fully characterized from family sources.

The book is without any documentation but is indexed; in fact the index reads like Lloyd's register of British ships: *Acheron, Alligator, Asiatic, Aurora, Bangalore, Beagle, Bengal Merchant, Betsy, Bounty, Buffalo, Chatham, Clio, County of Carnavon, Cuba, Discovery,* on to *Terror, Tory,* and *Virago!* Scented names they are full blown down the winds of history.—Joseph Ewan, Tulane University, New Orleans.

Wolffia columbiana in Methuen, Massachusetts.—While botanizing along the Merrimack River in Methuen on November 4, 1951, the pool at the mouth of Sawyer Brook was found to be covered by a mixture of *Lemna minor* L. and *Wolffia columbiana* Karst. Wolffia was not found at the mouth of Griffin Brook, a short distance upstream, or at the mouth of Bartlett Brook, a short distance downstream, although conditions were similar. Additional specimens were collected by Mr. Bean on November 11. Specimens will be deposited in the herbaria of the New England Botanical Club, Boston University, and the Peabody Museum of Salem.

Wolffia columbiana seems to be either a rare plant or a rarely collected species in New England. R. J. Eaton[1] mentions Lake Champlain; three localities in Connecticut; and two in Massachusetts, a collection made in Holyoke by W. E. Manning in 1933 and one made by Eaton in Concord in 1938. The Flora of Connecticut lists five additional localities in that state. Our station is the third record for Massachusetts, the first record for Essex County, and this note possibly sets a record for promptness of publication.—Stuart K. Harris and Ralph C. Bean.

[1] Eaton, R. J. 1939. Wolffia columbiana in Concord, Massachusetts. Rhodora **41**: 42, 43.

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